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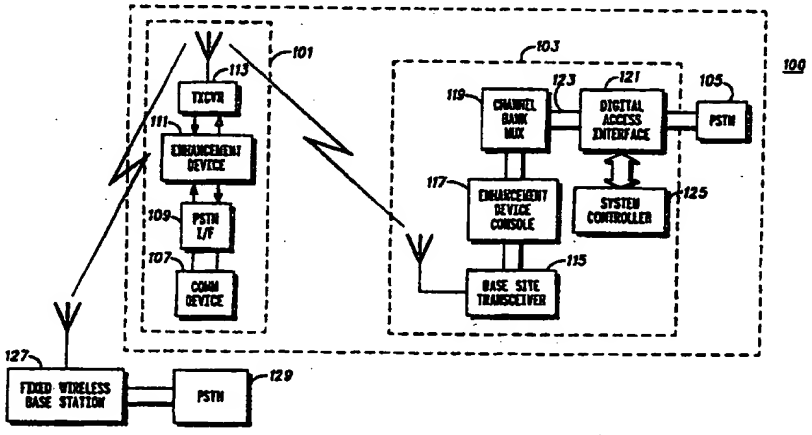

(57) Abstract

A fixed wireless telephone system (100) saves the tremendous cost of providing the infrastructure required for a wire line telephone system and allows rapid installation of the service. In particular, this fixed wireless telephone system (100) allows remote testing, maintenance and re-programming of a fixed wireless telephone (FWT 101) from a remote base station (103) as if it is a land line telephone apparatus connected via wires to the telephone central office. In order to facilitate this feature a special message is transmitted from a base station (103) to the FWT (101). The FWT (101) identifies the message as a silent maintenance call and disactivates the ringer circuitry. Upon reception of the message, the FWT (101) requests a call set-up (507) in the communication system (100) to a predetermined maintenance number. In a preferred embodiment, a system controller (125) in the base station (103) recognises the request to the predetermined maintenance number and provides a communication channel between the system controller (125) and the FWT (101). The base station (103) can now perform testing, maintenance and re-programming of the FWT (101). When remote re-programming, the preferred embodiment provides a verification process by providing a second communication channel from a second base station for verifying any re-programming that was performed by the first base station.

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AN APPARATUS FOR AND A METHOD OF TESTING AND MAINTAINING A COMMUNICATION DEVICE IN A COMMUNICATION SYSTEM

Field of the Invention

Generally, the present invention relates to communication systems and more particularly to testing and maintaining a communication device therein.

Background of the Invention

Generally, a fixed wireless telephone service is used as an alternative to wire line telephone service in rural or urban settings, particularly in developing countries. One way of providing a fixed wireless telephone service is to use a conventional cellular telephone system and couple it with a wire line telephone system to provide wireless service to fixed terminals throughout a geographic area. In wireline telephony, the operator monitors the operation of the telephone terminal and the integrity of the connecting lines and transmission facilities by performing a connectivity and a "loop back" test. The latter involves injection of a test tone and measurement of the returned echo. The same tests cannot be performed in cellular equipment. The cellular protocol does not support this type of testing. Subscribers are required to go to the service station to check their terminals. Sending technicians to service the FWTs is an expensive alternative.

Since these fixed terminals are provided throughout a geographic area, it would be desirable to provide remote re-programming, testing and maintenance of these fixed wireless terminals.

Summary of the Invention

A first aspect of the present invention provides a method of testing and maintaining a communication device for use in a communication system, the method comprising the steps of: transmitting an order message from a first base station to a first communication device; receiving the order message at the first communication device; and requesting a communication set-up in the communication system from the first communication device to a predetermined maintenance number. An additional feature transmits, responsive to said step of requesting a call set-up, a working condition bit stream from the first communication device to the base station indicating the status of the first communication device. This working condition bit stream may be part of the request for communication set-up or it may be accomplished using DTMF tones after a communication is set-up.

A second aspect of the present invention is a testing and maintenance apparatus for use in communication system. The testing and maintenance apparatus comprises a radio transmitter in a first base station for transmitting an order message to a first communication device; a radio receiver for receiving the order message at the first communication device; and a processor, responsive to receiving the order message, for requesting a call set-up in the communication system from the first communication device to a predetermined maintenance number, such that the first communication device may be tested, maintained and programmed by the first base station. This second aspect of the present invention may be used to remotely cell-split. In fixed wireless applications, the FWT is deliberately programmed to listen to a single signal channel. This single signal channel prevents unauthorised access by "foreign" FWTs and further isolates the FWT from unwanted interference of other base station signals. The second aspect of

the present invention allows a base station to remotely reprogram the signal channel on which an FWT communicates.

Brief Description of the Drawings

FIG. 1 is an illustration of a fixed wireless telephone service incorporating a conventional cellular telephone system and a conventional wire line telephone system in accordance with the present invention.

FIG. 2 is a detailed illustration in block diagram form of a base site inter-connection in accordance with the present invention.

FIG. 3 is an illustration in block diagram form of an enhancement device that resides in a special console and in a fixed wireless terminal in accordance with the present invention.

FIG. 4 is an illustration in process flow chart form of a method of testing and maintaining a communication device in a communication system in accordance with the present invention.

FIG. 5 is an illustration in process flow chart form of a second method of testing and maintaining a communication device in a communication system in accordance with the present invention.

FIG. 6 is an illustration in process flow chart form of a third method of testing and maintaining a communication device in a communication system in accordance with the present invention.

Detailed Description of a Preferred Embodiment

The preferred embodiment includes a description of a fixed wireless system that is a hybrid of a fixed wire-line telephone system and a conventional cellular radio system. It is intended as an alternative to wire line telephone system in rural or urban settings, particularly in developing countries. A fixed wireless telephone system saves the

tremendous cost of providing the infrastructure required for a wire line telephone system and allows rapid installation of the service.

In particular, this fixed wireless telephone system allows remote testing, maintenance and re-programming of the fixed wireless telephones (FWT) from a remote base station. In order to facilitate this feature a message is transmitted from a base station to the FWT. Upon reception of the message, the FWT requests a call set-up in the communication system to a predetermined maintenance number. In a preferred embodiment, a system controller in the base station recognises the request to the predetermined maintenance number and provides a communication channel between the system controller and the FWT. The base station can now perform testing, maintenance and re-programming of the FWT. The testing, maintenance and re-programming activities include cell-splitting, silent maintenance calls and fraud protection. Additionally, the preferred embodiment provides a verification process by providing a second communication channel from a second base station for verifying any re-programming that was performed by the first base station. In an alternate preferred embodiment, the predetermined maintenance number is chosen from a plurality of maintenance numbers each indicating a status of the FWT. Thus, by dialling the selected predetermined number, the FWT is indicating to the base station the status of the FWT. It is understood by the inventors that this invention could equally be applied to a conventional analogue or digital cellular radio telephone system. A maintenance number as used in this patent application refers to a pre-assigned, unattended number or numbers used to indicate to the base station that the desired communication is a maintenance related call. Additionally, in some applications the maintenance indicates the current status of the FWT.

FIG. 1 is an illustration of a fixed wireless communication system 100 including a fixed wireless terminal 101, a first fixed wireless base station 103, a second fixed wireless base station 125, a first conventional wire line switch 105 and a second conventional wire line switch 127. For ease of illustration only the first fixed wireless base

station 125 and the first conventional wire line switch 105 will be discussed in detail. However, the second fixed wireless base station 125 and the second conventional wire line switch 127 function identically to their respective kind. The fixed wireless terminal (FWT) 101 includes a traditional wire line communication device 107 such as a modem, a telephone or a fax machine. The fixed wireless terminal 101 additionally includes a PSTN interface 109, an enhancement device 111 and a cellular radio telephone transceiver 113.

The communication device 107 is any traditional wire line communication device such as a telephone, a fax machine or a modem. The communication device 107 is coupled to the PSTN interface via a traditional two-wire connection as is known in wire line communication systems. The PSTN interface 109 provides a traditional interface to a communication device such that the end user is not aware of any difference between a fixed wireless communication system and a fixed wire line communication system. Additionally, the PSTN interface detects traditional signalling created by the communication device 107, such as an off hook signal, an on hook signal and a switch hook signal. The PSTN interface 109 transmits the analogue audio between the communication device 107 and the enhancement device 111. Additionally, the PSTN interface 109 transmits the detected standard communication device signals (on hook, off hook, switch hook) to the enhancement device 111 and communicates any standard wire line signals such as an incoming call signal, a metering pulse or an end of call signal from the enhancement device to the communication device 107. The PSTN interface 109 also creates the ringing voltage that activates ringer circuitry of the standard telephone apparatus (such as a standard telephone set, a facsimile machine or any other like device). In response to the enhancement device 111 recognising an order message as a request for a silent maintenance call, the PSTN interface 109 dis-activates the ringer circuitry of the standard telephone apparatus.

The enhancement device 111 digitises the audio received from the PSTN interface 109 and transmits it to a standard cellular radio

telephone system transceiver 113. Likewise, the audio received from the transceiver 113 is converted to analogue audio signals. Likewise, the enhancement device 111 converts the digital audio received from the transceiver 113 to analogue audio and is output to the PSTN interface 109. Additionally, the enhancement device 111 provides the necessary enhancement for operating the traditional cellular transceiver 113 in a fixed wireless telephone environment. Specifically, in response to receiving an original off hook signal from the PSTN interface 109, the enhancement device requests a communication channel on the conventional cellular radio communication system by transmitting a pre-determined digital sequence to the transceiver 113. In the preferred embodiment this predetermined digital sequence is a "ghost" telephone number. The specific details of this request are described below. Additionally, the enhancement device 111 codes and decodes traditional wire line signals, such as on hook, off hook, flash hook, metering pulse and end of communication signals.

The transceiver 113 is a standard cellular radio telephone system transceiver. In a preferred embodiment, the transceiver is developed to meet the TACS analogue cellular radio telephone system. However, it is envisioned that any other traditional cellular radio telephone communication system could be substituted therefor including analogue and digital cellular systems. The transceiver 113 transmits and receives radio frequency "RF" signals to and from a base site transceiver 115 located in the fixed wireless base station 103. The base site transceiver 115 is comparable with the radio transceiver 113 of the fixed wireless terminal 101. The base site transceiver 115 sends and receives digital audio signals to and from an enhancement device console 117. The enhancement device console 117 contains a plurality of enhancement devices earlier described in relation to the fixed wireless terminal 101. Again, the enhancement devices 111 contained in the enhancement device console 117 digitise analogue audio signals transmitted thereto and pass those digital audio signals on to the base site transceiver 115. Likewise, the enhancement devices 11, contained within the enhancement device console 117,

transform received digital audio signals into audio signals for use in the traditional wire line telephone system. Additionally, the enhancement devices contained within the enhancement device console 117 code and decode the signals transmitted between enhancement device 111 of the fixed wireless terminal and enhancement devices in the enhancement device console 117.

The channel bank multiplexer (MUX) 119 is coupled to a digital access interface (DAI) 121 via an E1 trunk 123. The digital access interface 121 may be remotely located from the base site transceiver 115. In the preferred embodiment, the enhancement device console 117 and the channel bank MUX 119 and are coupled using a microwave link. The channel bank MUX 119 converts audio received from the digital access interface 121 into four-way audio which is then transmitted to the enhancement device console 117. Likewise, four-way audio received from the enhancement device console 117 is converted by the channel bank MUX 119 into one trunk and output to the digital access interface 121.

The digital access interface 121 provides a standard trunk level interface such as R2 or SAT, or a proprietary interface to the local central office switch. Thus, the DAI 121 interfaces between the E1 trunk 123 and the public switching telephone network 105. Additionally, the DAI 121 requests audio links on the wire line communication system and links the audio link on the wire line communication system with a communication channel on the conventional cellular radio telephone system, thus providing a link between the communication device 107 and the PSTN 105. Additionally, a system controller 125 is coupled to the DAI 121 to provide maintenance, testing and re-programming services to the FWT 101 as described in detail below.

FIG. 2 is a detailed illustration in block diagram form of a portion of the fixed wireless base station 103. Specifically, FIG. 2 includes the base site transceiver 115, the enhancement device console 117, the channel bank MUX 119, the E1 interface 123 and the interconnections

between these devices. The base site transceiver 115 includes a transceiver 201 for each of the radio communication channels to a fixed wireless communication device such as FWT 101 of FIG. 1. It should be noted that the number of transceivers necessary will vary depending upon the cellular system utilised in this communication system 100. Specifically, if a time division multiple access system is used, then each transceiver could service multiple fixed wireless telephony devices, thus, reducing the number of required transceivers. Each transceiver 201 of the base site transceiver 115 is coupled to the enhancement device console 117 via a four-wire connection 203. Each of the transceivers 201 are coupled to an enhancement device 111 contained within the enhancement device console 117. In the preferred embodiment, up to 30 transceivers and 30 corresponding enhancement devices may be utilised. Each of the enhancement device 111 transmits a four-wire analogue audio signal to and from the channel bank MUX 119 via lines 205. Additionally, the enhancement devices 111 code and decode the real time signalling bits which are used to transmit the traditional wire line signals such as on hook, off hook, flash hook, metering pulses and call termination via the real time signalling connections 207. A TST (test) card illustrated in FIG. 2 is used to connect each of the enhancement devices to a dedicated time slot of one of the E1 trunks 123. This connection establishes a control channel from the system controller (via modem), over the dedicated time slot of the E1 trunk via another modem to the TST card that is logically connected to the MED card at the base station, then communicating by radio with the corresponding enhancement device at the FWT.

FIG. 3 is a detailed illustration in block diagram form of a enhancement device 111 of the present invention. The enhancement device includes a DSP 301, a first codec 303, a second codec 305, external memory 307, an interface connector 309, a first set of filters 311 related to the first codec 303 and a second set of filters 313 related to the second codec 305. In the preferred embodiment, the DSP 301 is a 16 bit fixed point DSP operating at 80 megahertz (Mhz). For outgoing audio, the DSP 301 receives a string of binary numbers

representing an analogue audio signal. It converts this string to a digital stream that represents the actual data or voice received from the communication device 107 or from the PSTN 105. It then encodes the voice or data using the first code 303 or the second codec 305, filters the signals using the appropriate set of filters and transmits the encoded data/voice to the interface connector 309. For incoming audio, the DSP 301 performs decodes the data/voice digital signals, converting them back to an analogue audio signal, reversing the outgoing audio process previously described. Additionally, the enhancement device 111, encodes and decodes the traditional telephony signals (on hook, off hook, switch hook, metering pulses, call disconnect) on to and off of the audio signals received by and transmitted from the enhancement device 111.

FIG. 4 is an illustration in process flow diagram form of a method 400 of testing and maintaining the FWT 103 in accordance with the present invention. The process begins at step 401. At function block 403, the system controller 125 of FIG. 1 generates an order message to initiate a maintenance call. The order message is then routed through the DAI 121, the channel bank MUX 119 and the Enhancement device console 117 to the base site transceiver 115. The base site transceiver 115 transmits the order message to a first communication device, FWT 101. At process block 405, the FWT 101 receives the order message via antenna 114 and transceiver 113 of FIG. 1. The processor 301 of FIG. 3 detects the reception of the order message. At function block 406, the method 400 recognises the message as a silent maintenance call and deactivates the ringer circuitry. Next, the method requests a communication set-up from the FWT 101, or the first communication device, to a predetermined maintenance number at function block 407. In the preferred embodiment, processor 301 generates a dial digits package including a predetermined maintenance number stored in the external memory 307 followed by digits that report the working condition of the FWT 101. See the following table 1 for a scheme of this dial digits package.

The digits sent in the package supported by the cellular standard (e.g. TACS) are 0-9. In the following scheme, "00000166" is the default maintenance number, while the 'g' stands for a decimal digit. Thus, 'g | g' describes a byte containing 2 decimal digits. See Table 2 for the specific values of these digits in the preferred embodiment. Thus, using the common capability of all cellular terminal to dial a number, and assigning a predetermined set of numbers to represent a specific set of messages , all cellular terminal could be monitored either in a conventional cellular application or a fixed wireless terminal application.

The dial digits package is then transmitted from the transceiver 113, via antenna 114 to the first base station 103. If, due to some fault at the FWT 101 or otherwise, this package can not be generated properly, then the FWT 1010 will set the appropriate bit (in the first digit that follows the maintenance number) to 1, and the base system controller 125 will recognise this as a fault indication. At function block 409, the base station, specifically, the system controller, receives the dial digits package just like any other dial package. However, the system controller 125 is programmed to recognise this particular package as a dial package for the predetermined maintenance number. In response to this recognition, the system controller 125 does not pass this dial digits package on to the PSTN 105 of FIG. 1. Instead the system controller 125 obtains the FWT's state reporting digits from the package and sends them to an Operations and Maintenance centre. If the message is not of the defined length, or the faulty message bit is set, then the system controller will send a message to the Operations and Maintenance centre a message indicating a problem with the FWT 101. If further testing, maintenance or re-programming is desired, then the base station 103 sets up a communication channel between the system controller 125 and the FWT 101, at function block 411. The system controller 125 can then transmit a limited set of messages and requests to the FWT 101. For example, after receiving the dial digit bits, the system controller 125 may want additional information concerning a particular byte of stored data, or the status of a given

device. At function block 413, for each message and request received by the FWT 101, the FWT 101 responds with an acknowledgement or a response to the request. At 415, the process 400 ends. This first method is used to interrogate the status of the FWT. This method can be implemented in a conventional radio telephone system without the use of an enhancement device, such as that illustrated in FIG. 1. In order to perform the more complex functions, such as re-programming the signalling channel, an enhancement device is required to support the digital protocol.

As an alternative to the dial digits package the base station 103 can provide a communication channel as discussed at function block 411 and the FWT 101 may respond using DTMF (dual tone multiple frequency) tones to represent the current status of the FWT 101.

FIG. 5 is an illustration in process flow chart form of a method 500 of re-programming an FWT in response to a cell split in accordance with the present invention. Typically, in a conventional cellular communication system, each base site transceiver 115 of FIG. 1 provides radio communication service to a plurality of radio communication devices within a fixed geographic area. In order to increase the number of radio communication devices that can be serviced within a fixed geographic area, often an operator will increase the number of fixed site transceivers 115, this is referred to as a cell split. Because conventional radio communication devices roam and continually locate in new cells, they are constantly re-assigned to new fixed cite transceivers. However, fixed wireless terminals, such as FWT 101, are designed to be served by a single fixed site transceiver. This is a safety measure to prevent an unauthorised FWT from using the telephony service in an area that it is not entitled to use. Unlike conventional radio telephone systems, the fixed wireless telephony service restricts the access of a legitimate subscriber to a single base station. Thus, when an operator increases the number of fixed site transceivers in a given geographic area, some of the FWTs must be reprogrammed to listen to a new fixed site transceiver. FIG. 5 illustrates the method 500 of re-programming an FWT to

accommodate new fixed site transceivers. The method 500 begins at starting block 501. Function blocks 503 through 511 are identical in function to function blocks 403 through 411 of FIG. 4, consequently, the discussion concerning these blocks will not be repeated. Once the communication channel is established at function block 511, the base station 103 alters the signal channel of the first communication device at function block 513. In the preferred embodiment, the system controller 125 creates a write command with a new signal channel value for transmission to the FWT 101. Specifically, the command is 50H 16H abH cFH hhH llH, where a, b, c are the 3 digits that give the new signal channel, and the hh and ll are the CRC bytes. The new signal channel value is then transmitted to the FWT 101 via the fixed site transceiver 115. The processor 301 of FIG. 3 then stores the new signal channel value into the external memory 307 of FIG. 3. The communication between the system controller 125 and the FWT 101 is ended at function block 515. In the preferred embodiment, the communication is ended in the same way as a normal radio communication device phone call. At function blocks 517 - 519 a new maintenance communication is set-up as previously described. However, this maintenance communication is between the FWT 101 and its new fixed site transceiver contained in the second fixed wireless base station 127 of FIG. 1. This communication utilises the new signal channel to communicate to the second fixed wireless base station. Upon establishing a maintenance communication, the operation of the FWT 101 is verified at function block 523. In the preferred embodiment, the verification is performed by doing a FWT self-test. If the self-test is satisfactory, then the FWT 101 copies the new signal channel value to the default memory.

FIG. 6 is an illustration in process flow diagram form of an alternative preferred method 600 of testing and maintaining the FWT 103 in accordance with the present invention. The process begins at step 601. At function block 603, the system controller 125 of FIG. 1 generates an order message to initiate a maintenance call. The order message is then routed through the DAI 121, the channel bank MUX 119 and the Enhancement device console 117 to the base site

transceiver 115. The base site transceiver 115 transmits the order message to a first communication device, FWT 101. At process block 605, the FWT 101 receives the order message via antenna 114 and transceiver 113 of FIG. 1. The processor 301 of FIG. 3 detects the reception of the order message. At function block 606, the method 600 recognises the message as a silent maintenance call and deactivates the ringer circuitry. Next, the method requests a communication set-up from the FWT 101, or the first communication device, to a predetermined maintenance number at function block 607. In order to select the appropriate predetermined maintenance number, the processor 301 of FIG. 3 runs a self-check test on the FWT 101 and determines the current status of the FWT 101. The method 600 then selects the predetermined maintenance number from a plurality of predetermined maintenance numbers to indicate the current status of the communication device. Each predetermined maintenance number reflecting a different status of the FWT 101. The status of the FWT is organised like the status discussed in reference to Table 2 earlier. At function block 609, the first base station recognises the request for a call set-up to a pre-determined maintenance number. The number is transmitted to the system controller 125 of FIG. 1 as previously described and never transmitted to the PSTN 105 of FIG. 1. The method ends at block 611.

All of the above mentioned operation and maintenance (O&M) calls are performed while the ringer circuitry is dis-activated. That allows maintenance operations to take place at all times of the day without confusing the subscriber with false rings of the FWT.

What is claimed is:

CLAIMS

1. A method of testing and maintaining a communication device for use in a communication system, the method comprising the steps of:

transmitting an order message from a first base station to a first communication device;

receiving the order message at the first communication device; and

requesting a communication set-up in the communication system from the first communication device to a predetermined maintenance number.

2. The method of claim 1 wherein the predetermined maintenance number is selected from a group of predetermined maintenance numbers and the number is indicative of the state of the first communication device.

3. The method of claim 1 further comprising the step of disabling, responsive to the step of receiving, a portion of circuitry of the first communication device.

4. The method of claim 1 further comprising the steps of:

recognising, responsive to the step of receiving, the order message as a request for a silent maintenance call; and

disabling, responsive to the step of recognising, a ringer circuit of the first communication device.

5. The method of claim 1 further comprising the steps of:

transmitting, responsive to said step of requesting, a working condition bit stream from the first communication device to the base station.

6. The method of claim 5 wherein transmitting the working condition bit stream is accomplished using DTMF (dual tone multiple frequency) tones.

7. The method of claim 1 wherein the step of requesting includes the step of transmitting a dial digits package from the first communication device to the base station.

8. The method of claim 1 wherein the dial digits package includes a working condition bit stream in addition to the predetermined maintenance number.

9. The method of claim 1 further comprising the steps of:

altering the signal channel of the first communication device;

ending the communication to the predetermined maintenance number;

transmitting an order message from a second base station to the first communication device;

receiving the order message at the first communication device;

requesting a communication set-up in the communication system from the first communication device to a second predetermined maintenance number; and

verifying first communication device is operational on the altered signal channel.

10. The method of claim 1 further comprising the steps of:

re-programming a setting of the first communication device;

ending the call to the predetermined maintenance number;

transmitting a second order message to the first communication device;

receiving the order message at the first communication device;

requesting a communication set-up in the communication system from the first communication device to a second predetermined maintenance number; and

verifying the first communication device is operational using the programmed setting.

11. The method of claim 10 wherein the step of transmitting a second order message is transmitted from a second base station.

12. The method of claim 10 wherein the step of transmitting a second order message is transmitted from the first base station.

13. The method of claim 10 wherein the first and the second predetermined maintenance numbers are the same.

14. The method of claim 1 further comprising the steps of:

recognising in the first base station the request for a call set-up to a predetermined maintenance number;

providing, responsive to said step of recognising, a communication channel between a system controller in the first base station and the first communication device.

15. A testing and maintenance apparatus for use in communication system, the testing and maintenance apparatus comprising:

a radio transmitter in a first base station for transmitting an order message to a first communication device;

a radio receiver for receiving the order message at the first communication device; and

a processor, responsive to receiving the order message, for requesting a call set-up in the communication system from the first communication device to a predetermined maintenance number, such that the first communication device may be tested, maintained and programmed by the first base station.

16. The testing and maintenance apparatus of claim 15 further comprising a radio transmitter in the first communication device, responsive to the processor, transmitting a working condition bit stream from the first communication device to the base station.

17. The testing and maintenance apparatus of claim 15 wherein the processor further comprises a means for selecting the predetermined maintenance number from a plurality of predetermined maintenance numbers, wherein the selected predetermined maintenance number identifies the present state of the first communication device.

18. The testing and maintenance apparatus of claim 15 wherein the processor further comprises a means for disabling a ringer circuitry of the first communication device.

19. The testing and maintenance apparatus of claim 16 wherein transmitting the working condition bit stream is accomplished using DTMF (dual tone multiple frequency) tones.

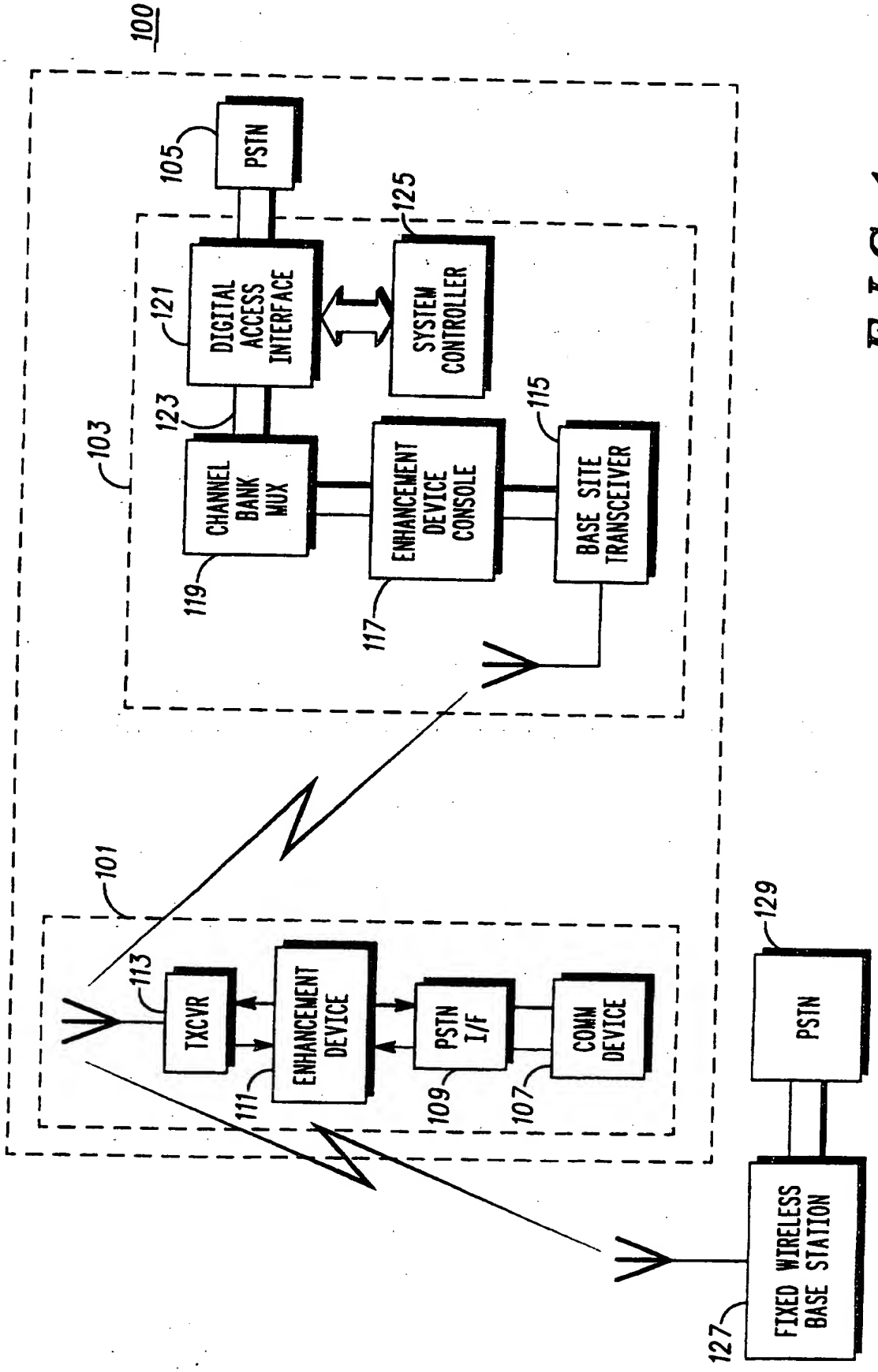
20. The testing and maintenance apparatus of claim 15 further comprising a second radio transmitter in a second base station for verifying any re-programming performed by the first base station.

21. The testing and maintenance apparatus of claim 15 further comprising a system controller for recognising the processors request for a call set-up and providing a communication channel between a system controller in the first base station and the first communication device.

22. The testing and maintenance apparatus of claim 15 wherein the first communication device is a fixed wireless terminal.

23. The testing and maintenance apparatus of claim 15 wherein the first communication device is a cellular radio telephone.

24. The testing and maintenance apparatus of claim 15 wherein the first communication device is an analogue cellular radio telephone.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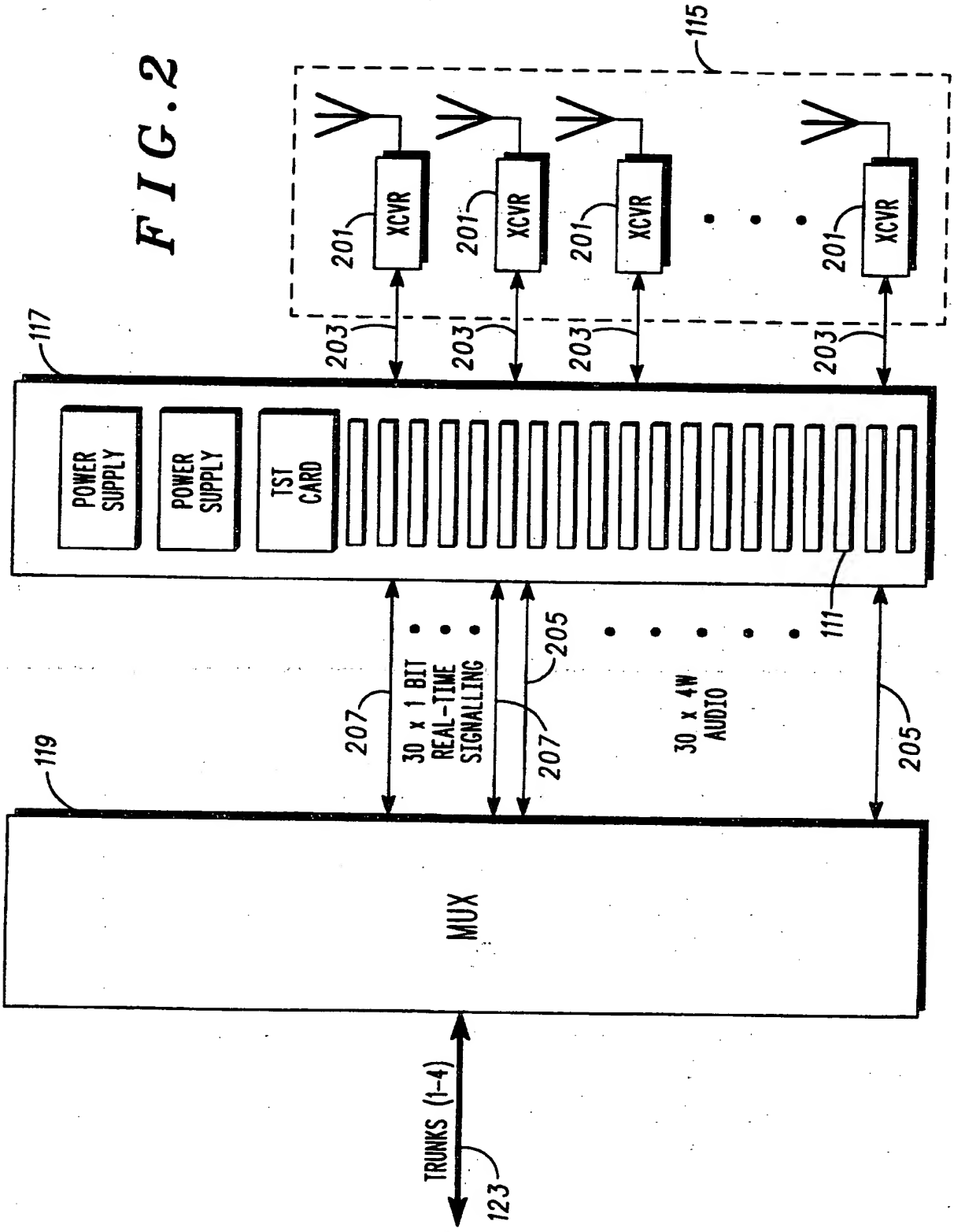
PSTN
105
125
DIGITAL ACCESS INTERFACE
121
SYSTEM CONTROLLER
123
103
CHANNEL BANK MUX
ENHANCEMENT DEVICE CONSOLE
115
BASE SITE TRANSCEIVER
119
117
101
113
TXCVR
ENHANCEMENT DEVICE
PSTN I/F
COMM DEVICE
111
109
107
129
PSTN
FIXED WIRELESS BASE STATION
127

FIG.1

FIG. 2


115
XCVR
201
203
117
POWER SUPPLY
POWER SUPPLY
TST CARD
111
205
207
30 x 1 BIT REAL-TIME SIGNALLING
30 x 4W AUDIO
119
MUX
TRUNKS (1-4)
123

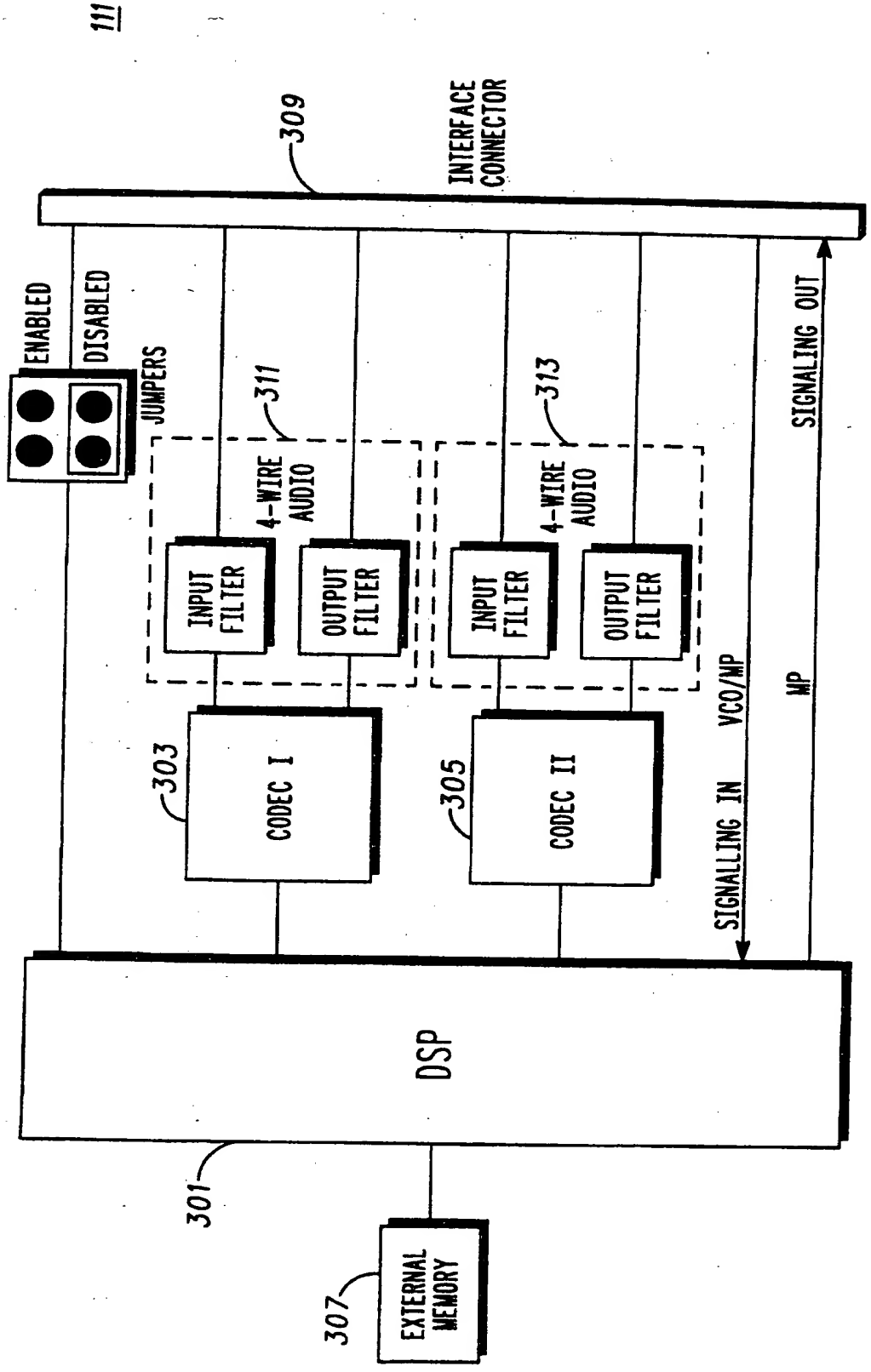

111
309
INTERFACE CONNECTOR
ENABLED
DISABLED
JUMPERS
311
313
4-WIRE AUDIO
4-WIRE AUDIO
INPUT FILTER
OUTPUT FILTER
INPUT FILTER
OUTPUT FILTER
SIGNALING OUT
VCO/MP
MP
SIGNALLING IN
303
CODEC I
305
CODEC II
DSP
301
307
EXTERNAL MEMORY

FIG.3

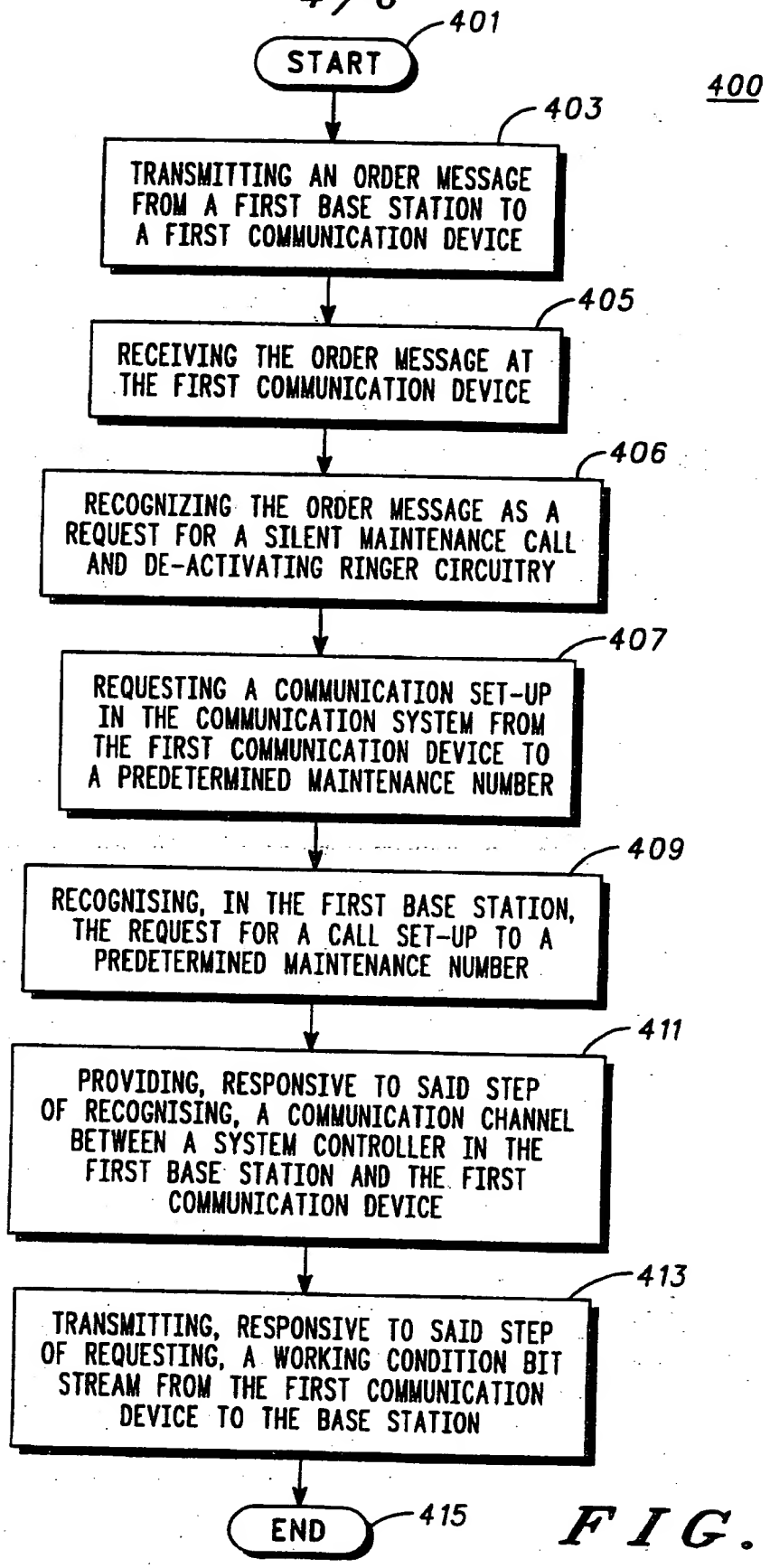

400
START
401
TRANSMITTING AN ORDER MESSAGE FROM A FIRST BASE STATION TO A FIRST COMMUNICATION DEVICE
403
RECEIVING THE ORDER MESSAGE AT THE FIRST COMMUNICATION DEVICE
405
RECOGNIZING THE ORDER MESSAGE AS A REQUEST FOR A SILENT MAINTENANCE CALL AND DE-ACTIVATING RINGER CIRCUITRY
406
REQUESTING A COMMUNICATION SET-UP IN THE COMMUNICATION SYSTEM FROM THE FIRST COMMUNICATION DEVICE TO A PREDETERMINED MAINTENANCE NUMBER
407
RECOGNISING, IN THE FIRST BASE STATION, THE REQUEST FOR A CALL SET-UP TO A PREDETERMINED MAINTENANCE NUMBER
409
PROVIDING, RESPONSIVE TO SAID STEP OF RECOGNISING, A COMMUNICATION CHANNEL BETWEEN A SYSTEM CONTROLLER IN THE FIRST BASE STATION AND THE FIRST COMMUNICATION DEVICE
411
TRANSMITTING, RESPONSIVE TO SAID STEP OF REQUESTING, A WORKING CONDITION BIT STREAM FROM THE FIRST COMMUNICATION DEVICE TO THE BASE STATION
413
END
415

FIG. 4

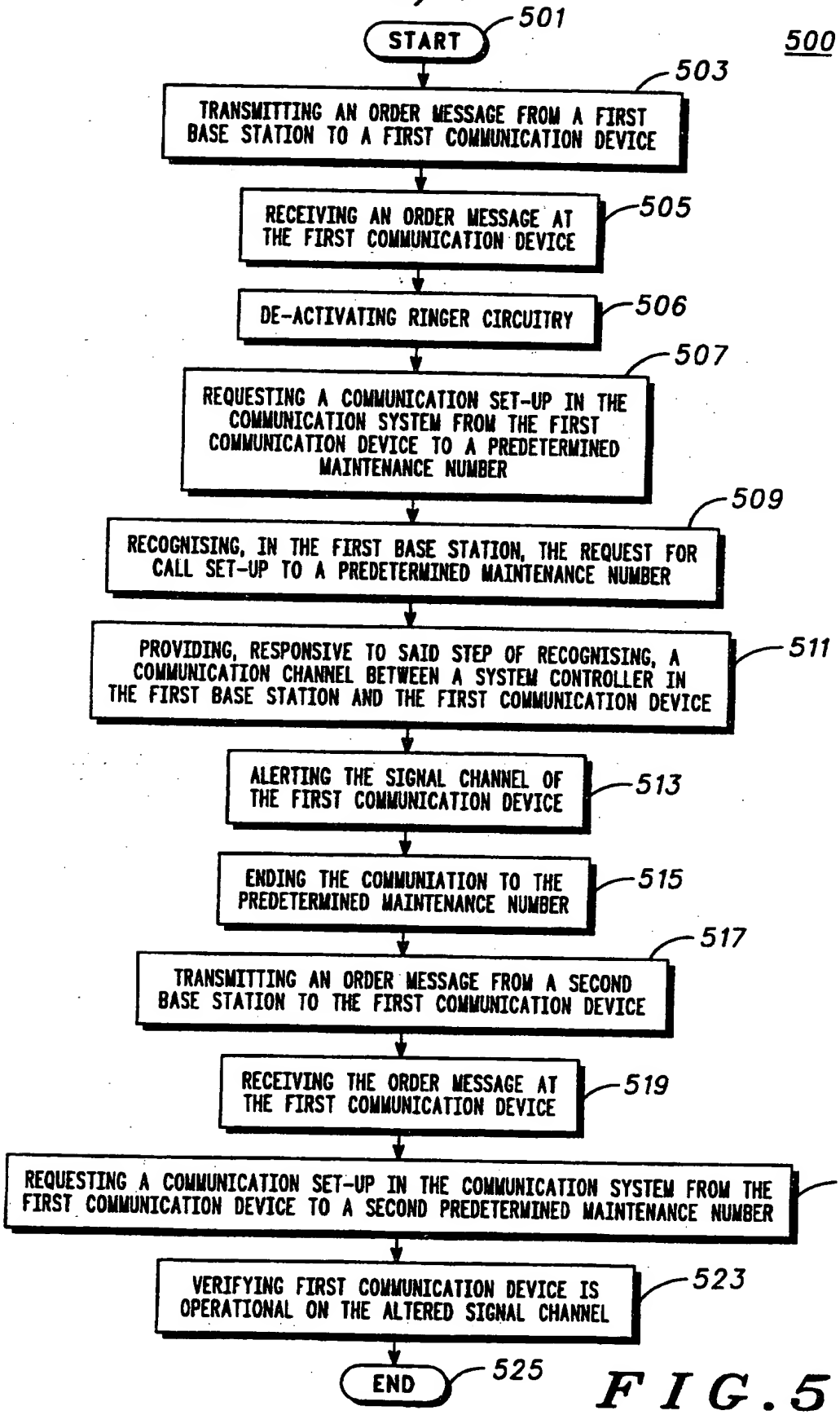

500
START
501
TRANSMITTING AN ORDER MESSAGE FROM A FIRST BASE STATION TO A FIRST COMMUNICATION DEVICE
503
RECEIVING AN ORDER MESSAGE AT THE FIRST COMMUNICATION DEVICE
505
DE-ACTIVATING RINGER CIRCUITRY
506
REQUESTING A COMMUNICATION SET-UP IN THE COMMUNICATION SYSTEM FROM THE FIRST COMMUNICATION DEVICE TO A PREDETERMINED MAINTENANCE NUMBER
507
RECOGNISING, IN THE FIRST BASE STATION, THE REQUEST FOR CALL SET-UP TO A PREDETERMINED MAINTENANCE NUMBER
509
PROVIDING, RESPONSIVE TO SAID STEP OF RECOGNISING, A COMMUNICATION CHANNEL BETWEEN A SYSTEM CONTROLLER IN THE FIRST BASE STATION AND THE FIRST COMMUNICATION DEVICE
511
ALERTING THE SIGNAL CHANNEL OF THE FIRST COMMUNICATION DEVICE
513
ENDING THE COMMUNIATION TO THE PREDETERMINED MAINTENANCE NUMBER
515
TRANSMITTING AN ORDER MESSAGE FROM A SECOND BASE STATION TO THE FIRST COMMUNICATION DEVICE
517
RECEIVING THE ORDER MESSAGE AT THE FIRST COMMUNICATION DEVICE
519
REQUESTING A COMMUNICATION SET-UP IN THE COMMUNICATION SYSTEM FROM THE FIRST COMMUNICATION DEVICE TO A SECOND PREDETERMINED MAINTENANCE NUMBER
521
VERIFYING FIRST COMMUNICATION DEVICE IS OPERATIONAL ON THE ALTERED SIGNAL CHANNEL
523
END
525

FIG. 5

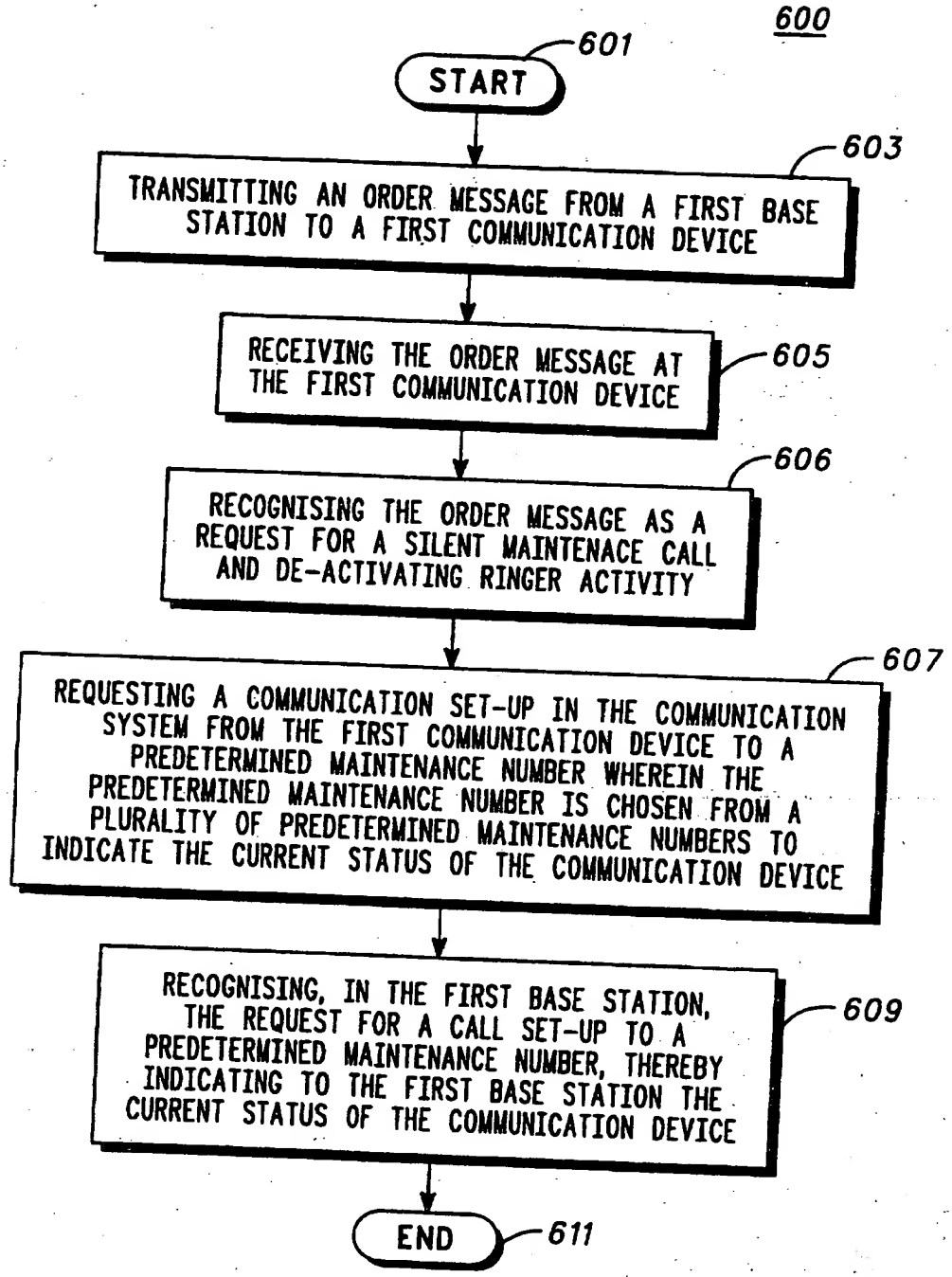

600
601
START
603
TRANSMITTING AN ORDER MESSAGE FROM A FIRST BASE STATION TO A FIRST COMMUNICATION DEVICE
605
RECEIVING THE ORDER MESSAGE AT THE FIRST COMMUNICATION DEVICE
606
RECOGNISING THE ORDER MESSAGE AS A REQUEST FOR A SILENT MAINTENACE CALL AND DE-ACTIVATING RINGER ACTIVITY
607
REQUESTING A COMMUNICATION SET-UP IN THE COMMUNICATION SYSTEM FROM THE FIRST COMMUNICATION DEVICE TO A PREDETERMINED MAINTENANCE NUMBER WHEREIN THE PREDETERMINED MAINTENANCE NUMBER IS CHOSEN FROM A PLURALITY OF PREDETERMINED MAINTENANCE NUMBERS TO INDICATE THE CURRENT STATUS OF THE COMMUNICATION DEVICE
609
RECOGNISING, IN THE FIRST BASE STATION, THE REQUEST FOR A CALL SET-UP TO A PREDETERMINED MAINTENANCE NUMBER, THEREBY INDICATING TO THE FIRST BASE STATION THE CURRENT STATUS OF THE COMMUNICATION DEVICE
611
END

FIG.6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 97/00741

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/34 H04Q7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 651 586 A (ALCATEL STANDARD ELECTRICA) 3 May 1995 see column 4, line 12 - column 6, line 12 see claims 1-6	1,15
A	US 5 109 403 A (SUTPHIN MELVIN W) 28 April 1992 see column 6, line 18 - column 8, line 49 see figure 4	1,15
A	EP 0 344 624 A (NIPPON ELECTRIC CO) 6 December 1989 see column 3, line 43 - column 5, line 31 see figure 4	1,15
A	EP 0 673 176 A (SIEMENS AG) 20 September 1995 see column 2, line 5-31	1,15

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 November 1997	27/11/1997

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Roberti, V

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 97/00741

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	EP 0 766 441 A (AT & T CORP) 2 April 1997 see column 5, line 42 - column 7, line 57 see figures 6,7	1,3

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/IB 97/00741

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		JP 9168053 A	24-06-97